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(21) International Application Number: PCT/GB99/01854 (22) International Filing Date: 11 June 1999 (11.06.99) (30) Priority Data: 198 26 978.1 18 June 1998 (18.06.98) DE (71) Applicant (for all designated States except US): BERNARD MATTHEWS PLC [GB/GB]; Great Witchingham Hall, Great Witchingham, Norwich, Norfolk NR9 5QD (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): MATTHEWS, Bernard, Trevor [GB/GB]; Great Witchingham Hall, Norwich, Norfolk NR9 5QD (GB). JOLL, David, John [GB/GB]; Irmingham Hall, Corpusty, Norfolk NR11 6QF (GB). KOPPERS, Werner [DE/DE]; Metjendorfer Landstrasse 236, D-26215 Wiefelstede (DE). BUSE, Friedrich [DE/DE]; Butadinger Strasse 139, D-26215 Oldenburg (DE). (74) Agents: EVANS, David, Charles et al.; fJ Cleveland, 40-43 Chancery Lane, London WC2A 1JQ (GB).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: NOVEL MEAT PRODUCT COMPRISING YOGURT AND PROCESS FOR PRODUCING THE SAME		
(57) Abstract A novel meat product is provided which comprises a monolithic piece of meat that is injected with yogurt and processed mechanically to distribute the yogurt substantially uniformly throughout the piece. The product may comprise 5 to 50 % by weight of injected yogurt. Said yogurt may have a pH of less than 5.2, preferably about 3.8 to 3.9 to improve the shelf-life of a raw meat product. Alternatively, the meat product may be cooked, and the yogurt may have a pH of 4.8 to 5.1 to ensure that the overall pH of the meat product does not fall too close to the isoelectric point of the meat, thus preserving the natural moisture and juiciness of the meat during and after cooking.		

Novel Meat Product Comprising Yogurt and Process for
Producing the Same

The present invention relates to a novel meat product comprising yogurt.

5 In particular, the present invention relates to a meat product comprising a monolithic piece of meat that is injected with yogurt. The present invention also relates to a process for producing a meat product injected with yogurt.

Yogurt and other fermented milk products are used in many traditional recipes for marinading and/or pickling meat. For example, it is well known to
10 marinade venison in sour buttermilk.

Russian Patent Specification No. 2084184 discloses a fermented meat product obtained by pickling the meat product in the presence of a fermented milk product.

According to these recipes, yogurt is used to impart a sharp, tangy
15 flavour to a marinated, outer zone of the meat product.

WO-A-99/21438 discloses a cooked sausage comprising a mixture of meat emulsion and mild yogurt, wherein the yogurt is substantially homogeneously dispersed through the meat emulsion, and the mixture has a pH of about 5.5 or more. The water retaining capacity of the meat is thus retained,
20 providing a sausage having desirable organoleptic qualities. Said mild yogurt may be prepared from milk mixtures by inoculation by slow working yogurt starter cultures. An advantage of the sausage product of WO-A-99/21438 is that it contains fewer calories per unit weight than conventional meat sausages and is generally easier to digest.

25 An object of the present invention is to provide a novel meat product.

In particular, it is an object of the present invention to provide a novel meat product comprising a monolithic piece of meat, that is a piece of meat that retains its natural structure and consistency. The term "monolithic" thus embraces whole muscle pieces of meat, as well as smaller, but nevertheless
5 recognisable pieces such as slices and strips of meat and cubed or diced meat, and also referred meat such, for example, as reformed steaks. The term "monolithic" is intended to exclude meat pieces which have been subjected to more severe mechanical processing such as minced or comminuted meat and meat emulsions or doughs of the kind that are formed into sausages, for
10 example.

A further object of the present invention is to provide a novel meat product comprising yogurt, which is thus lighter in terms of its calorie-content per unit weight as compared with unprocessed meat and is easier to digest.

Yet another object of the present invention is to provide a raw meat
15 product which has a longer shelf life as compared with natural cuts of raw meat.

Yet another object of the present invention is to provide a meat product having a novel aroma and/or taste.

Yet another object of the present invention is provide an industrial process for producing such a meat product.

20 According to one aspect of the present invention therefore, there is provided a meat product comprising a monolithic piece of meat, characterised in that said piece has been injected with yogurt and then processed mechanically to distribute said yogurt substantially uniformly throughout the piece.

According to another aspect of the present invention, there is provided a
25 process for making a meat product, characterised by injecting a monolithic piece

of meat with yogurt and thereafter mechanically processing the meat to distribute the yogurt substantially uniformly through the meat.

The injected yogurt may be distributed further throughout the piece of meat by mechanically tenderising and/or and/or tumbling. Said product may
5 comprise 5-50% by weight of injected yogurt. It has been found that by injecting yogurt into a monolithic piece of meat in accordance with the invention, pores and cavities within the piece may be filled with yogurt and, where higher proportions of yogurt are used, the piece may become saturated with yogurt. The invention thus provides a meat product having attractive, novel
10 organoleptic properties. By the addition of yogurt the calorie-content per unit weight of the product is reduced as compared with natural meat, and the product as a whole may be generally easier to digest. As a further advantage, the mechanical processing of the meat after injection assists in disrupting the structure of the meat, especially proteins, which may thus be opened, and free
15 water within the meat may become incorporated properly within the meat structure. As a result, meat processed in accordance with the invention will typically be tender and juicy after cooking.

The product of the present invention may be cooked as part of the production process, or alternatively the product may be supplied raw for cooking
20 by a consumer.

Where the product is to be supplied raw, e.g. for cooking at home by a consumer, the yogurt may have a pH less than 5.2, preferably less than 4.8. In some embodiments, the yogurt may have a pH in the range of 3.6 to 4.0, for example 3.8 or 3.9. By using yogurt having such a low pH, the acidity of the
25 product as a whole is increased which tends to suppress the proliferation of

unwanted microorganisms within the meat before cooking. Thus, the product of the present invention may have a longer shelf as compared with natural raw meat.

On the other hand, where the product is to be cooked as part of the production process, e.g. for sale as a cooked cold cut, it is preferable to use yogurt for injection that has a pH which is selected such that, when mixed with the meat, the pH of the product does not fall too close to the isoelectric point of the meat. To this end, the overall pH of the product should be not less than 5.0, and is preferably at least 5.5. The pH of the yogurt which should be used to ensure that the pH of the product falls within these ranges will obviously vary depending on how much yogurt is incorporated into the product. However, the yogurt will typically have a pH in the range of 4.8 to 5.1. By maintaining the pH of the product as a whole above the isoelectric point of the meat, the loss of moisture and water from the product during cooking is minimised. On the other hand, if the pH of the product falls below about pH 5.5 towards the isoelectric point of the meat, then the water-retaining capacity of the meat is reduced, with the result that the juiciness and texture of the final product is impaired.

The product in accordance with the present invention may therefore be injected with a mild yogurt that is prepared in the traditional manner, but is used in the process of the invention before fermentation is fully completed. Thus, after inoculation of a milk mixture, the pH may be monitored until it reaches a desired value. The mild yogurt produced as a result is then made ready for use in the method of the present invention.

Prior to injection, the yogurt may be treated to destroy the yogurt cultures and any other bacteria present in the yogurt. In some embodiments,

fermentation of the yogurt may be quenched by cooling the yogurt to a temperature in the range -2 to 6°C, preferably about -1°C. The yogurt may be cooled rapidly with liquid nitrogen or using a plate-heat exchanger.

Alternatively, the yogurt may be heated to a temperature in the range 65 to 70 °C, for instance by using a heat exchanger instead of cooled.

In order to assist in controlling accurately the pH of the yogurt to be injected into the meat piece, slow-working yogurt starter cultures are preferably used. Such slow-working yogurt cultures may comprise L.acidophilus, Bifidobacteria, and S.thermophilus. Further, the yogurt is preferably stirred continuously before use to allow accurate pH control.

In some embodiments, the mild yogurt may comprise an edible alkaline additive to neutralise the acidity of the yogurt. Said alkaline additive may comprise, for example carbonated soda. Phosphates could also be used to stabilise the mixture.

In a further aspect of the present invention, the yogurt injected into the meat piece may comprise active yogurt with live yogurt cultures, so that the resultant yogurt cultures in the product act as protective cultures which hinder the reproduction of undesirable microorganisms in the meat. Said live yogurt cultures may be found in yogurt having a low pH for injection into meat intended to be supplied raw, as well as in yogurt having a relatively high pH for injection into meat intended to be cooked as part of the manufacturing process. Prior to injection, the yogurt may be combined with additional condiments and/or flavourings. Said yogurt may comprise 5 to 25% by weight (based on the yogurt) of such additional flavourings and condiments. For example, the yogurt may be mixed with seasonings such as salt and pepper, sodium ascorbate, honey

or other flavourings such as smoke flavour or roast flavour.

In some embodiments, said yogurt may comprise up to 10% by weight of a pre-biotic additive such as a non-digestible carbohydrate. An example of a pre-biotic carbohydrate is inulin. The yogurt may comprise 1-10 %wt inulin, which selectively promotes the activity of some health promoting bacteria in the colon.

Said yogurt may be injected into the meat piece using a single needle injector or a multi-needle injector. A suitable multi-needle injector is the injector that is commercially available from Schröder Maschinenbau GmbH under the trade name "Pökelinjektor N120". The yogurt may be injected at a pressure of about 0.9 to 3.0 bar depending on the type of meat and injection rate. The meat may be injected more than once. In some embodiments, the meat may be injected using tenderising needles.

After injection and mechanical processing, the product may be directly packaged if it is to be sold raw. Alternatively, the product may be coated with spices and/or marinades and optionally cut prior to packaging. As a further alternative, the product may be cooked and optionally smoked and then packaged. As with the raw product, the meat may be further divided into portions or slices prior to packaging as required. In some embodiments, the product may be shaped into any desired shape. For instance, the meat, after injection and tumbling, may be extruded to form an elongate log of generally circular or oval cross section using apparatus of the kind described in EP-A-0024790 or EP-A-0850566.

The meat piece may comprise meat from any kind of slaughtered animal. For instance, the meat may comprise red meat, such, for example, as beef,

venison, lamb or pork; or poultry, such, for example, as turkey or chicken.

Following is a description by way of example only with reference to the accompanying drawings of methods of carrying the present invention into effect.

In the drawings:

5 Figure 1 is a flow diagram of a process in accordance with the present invention.

Figure 2a is a schematic plan view of a meat product in accordance with the present invention.

Figure 2b is a schematic isometric view of a slice of the meat product of
10 Figure 2a.

Figure 3a is a schematic side view of a different product in accordance with the present invention.

Figure 3b is a schematic isometric view of a slice of the product of Figure 3a.

15 With reference to Figure 1, yogurt is manufactured substantially according to the traditional manner using milk that is clarified and separated into cream and skimmed milk and then standardised to achieve a desired fat content. The desired proportions of cream and skimmed milk are then blended together, and the mixture is pasteurised and homogenised. The homogenised mixture is
20 heated to a temperature in the range 85 to 90°C for about 30 minutes, and is then cooled to a temperature in the range about 30 to 50°C. After cooling the mixture is inoculated with yogurt starter cultures. The mixture is allowed to ferment for about 4 to 6 hours at 30-50°C, typically about 43°C, such that the mixture coagulates to form yogurt. The pH of the mixture is carefully
25 monitored until a desired pH is reached. For products that are intended to be

supplied raw to a consumer, the yogurt may be fermented until it is fully fermented in the range 3.6 to 5.1, preferably about 3.8 to 3.9. Alternatively, for meat products intended to be cooked as part of the manufacturing process and then supplied to a consumer for reheating, yogurt may be fermented to a relatively higher pH in the range of 4.8 to 5.1 using a slow working starter culture comprising S. thermophilus, L. acidophilus and Bifidobacteria.

Once the desired yogurt pH has been reached, the yogurt is subjected to shock freezing to a temperature of -1°C to prevent further fermentation of the yogurt. For such shock freezing, liquid nitrogen or a plate-heat exchanger may be used. As an alternative the yogurt could be heated using a heat exchanger to a temperature in the range 65 to 70 °C. This is especially convenient for yogurt having a low pH for injection into meat that is to be sold raw.

If desired, the fermented yogurt may then be blended with additional spices or other additives.

Contemporaneously, raw meat is provided in the form of monolithic pieces. Said pieces may be whole muscle or reformed pieces or alternatively said meat may be mechanically divided to form smaller pieces such as cubes or strips. The meat is weighed into portions of a predetermined weight, and is then combined with the yogurt using a multi needle injector, such as the "Pökelinjektor N120" available from Schröder Maschinenbau GmbH. The yogurt, with optional additives, is injected into the meat at a pressure of about 0.9 to 3.0 bar depending on the type of meat and the size of the needles. After injection of a predetermined amount of yogurt, the product is tumbled to distribute the yogurt substantially uniformly throughout the monolithic meat piece.

The product can then be packaged for dispatched. Alternatively, it may

be blended with spices and/or other marinades and packaged. Optionally, the pieces may be further mechanically divided, for example, by being formed into slices.

In yet another alternative, the meat pieces after tumbling may be
 5 packaged and/or stuffed and then cooked and/or smoked prior to packaging. Again, the product may be divided further prior to packaging for dispatch.

Example 1

A pork steak with yogurt product is prepared as described above using the
 10 following recipe:

Pork Steak with Yogurt

Boneless Pork Loin	73 kg
Yogurt Mix for Injection	
15 Yogurt	25 kg
Salt	1,7 kg
Pepper	0,18 kg
Roast flavour	0,12 kg
20 Total	100 kg

As can be seen, 25 kg yogurt is combined with salt, pepper and a proprietary

roast flavour. The yogurt mixture is then injected into 73 kg of boneless pork loin and tumbled. The resultant product is shown schematically in Figure 2a, and a slice through the product having approximately the weight of an individual portion is shown in Figure 2b.

5

Example 2

A turkey breast with yogurt and honey product is made following the above procedure, with the following recipe:

Turkey Breast with Yogurt and Honey

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Turkey breast		70 kg
Yogurt Mix for Injection:		
Yogurt		24 kg
Curing salt		2 kg
Sodium ascorbate		0,3 kg
Honey		3,5 kg
Smoke flavour		0,2 kg
Total		100 kg

24 kg of yogurt is mixed with curing salt, sodium ascorbate, honey and a proprietary smoke flavour. The yogurt mix is then injected into whole muscle turkey breast portions having a weight of 70 kg. The product is then tumbled and extruded through a stuffing horn into a shirred casing. The resulting product is shown schematically in Figure 3a.

The extruded product is then cooked and smoked as follows:

**Cooking and Smoking Procedure
for Turkey Breast with Yogurt and Honey**

5	Step	Time	Process	Temp	
	1	30 min	cooking	45°C	
	2	30 min	cooking	55°C	
	3	10 min	cooking	60°C	
	4	10 min	cooking	65°C	
10	6		cooking	75°C	to a core temperature of 72°C
	7	Cold water shower for 60 minutes			
	8	30 min	drying		50°C
	9	30 min	smoking		50°C
15	10	Cooling in chiller for 12 hours			

After cooking and smoking, the casing is stripped from the product which is then sliced and repackaged for dispatch.

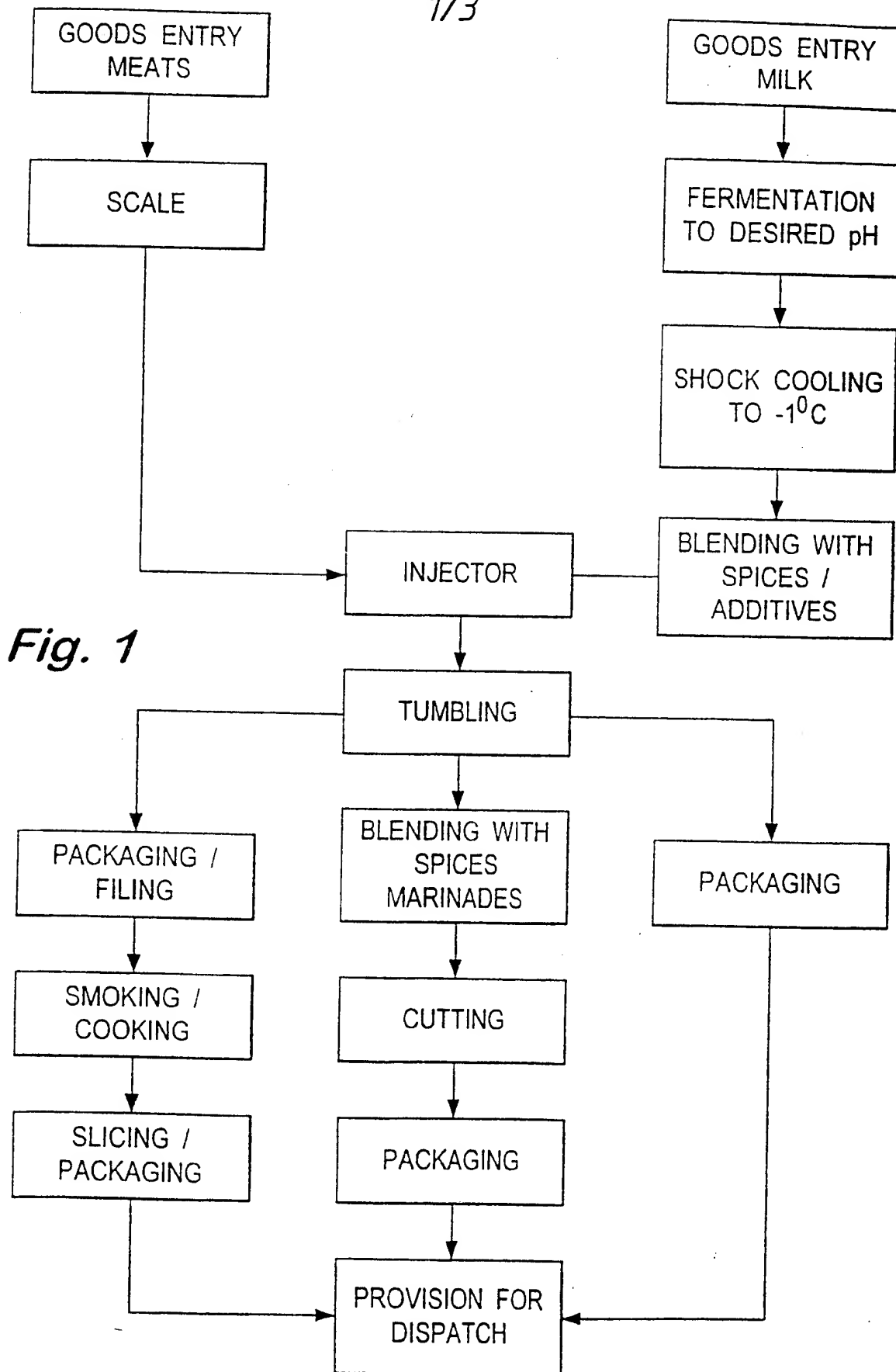
CLAIMS

1. A meat product comprising a monolithic piece of meat, characterised in that said piece has been injected with yogurt and then processed mechanically to
5 distribute said yogurt substantially uniformly throughout the piece.
2. A meat product as claimed in claim 1, comprising 5 to 50% by weight of injected yogurt.
- 10 3. A meat product as claimed in claim 1 or claim 2 which is raw.
4. A meat product as claimed in claim 3 wherein the yogurt has a pH of less than 5.2, preferably 3.8 to 3.9.
- 15 5. A meat product as claimed in claim 1 or claim 2, wherein said product is cooked.
6. A meat product as claimed in claim 5, wherein the product has a pH of not less than 5.0, preferably at least 5.5 .
- 20 7. A meat product as claimed in any preceding claim wherein said yogurt comprises 5 to 25% by weight of additional flavourings and/or condiments.
8. A meat product as claimed in any preceding claim wherein said yogurt
25 comprises up to 10% by weight of pre-biotic additive.

9. A process for making a meat product, characterised by injecting a monolithic piece of meat with yogurt, and thereafter mechanically processing the meat to distribute the yogurt substantially uniformly throughout the meat.
- 5 10. A process as claimed in claim 9 wherein said yogurt is distributed further throughout the piece of meat by tenderising and/or tumbling.
11. A process as claimed in claim 9 or claim 10 comprising 5 to 50% by weight injected yogurt.
- 10 12. A process as claimed in claim 9, claim 10 or claim 11 wherein said yogurt has a pH of less than 5.2, preferably 3.8 to 3.9.
13. A process as claimed in claim 9, claim 10 or claim 11, further
- 15 comprising cooking the meat product.
14. A process as claimed in claim 13 wherein said product has a pH of not less than 5.0, preferably at least 5.5.
- 20 15. A process as claimed in claim 14, wherein the monolithic piece of meat is injected with a mild yogurt having a pH of 4.8 to 5.1.
16. A process as claimed in any of claims 9 to 15, wherein prior to injection the yogurt is treated to destroy yogurt cultures and any other bacteria present in
- 25 the yogurt.

17. A process as claimed in claim 16 wherein the yogurt is treated by cooling to a temperature in the range -2 to 6°C.
18. A process as claimed in claim 16 wherein the yogurt is treated by heating
5 to a temperature in the range 65 to 70°C.
19. A process as claimed in any of claims 9 to 18 wherein the yogurt is made using slow working starter cultures.
- 10 20. A process as claimed in any of claims 9 to 19 wherein the yogurt comprises an edible alkaline additive to neutralise the acidity of the yogurt.
21. A process as claimed in any of claims 9 to 20 wherein the yogurt is injected into the meat piece using a single needle injector or a multi-needle
15 injector.

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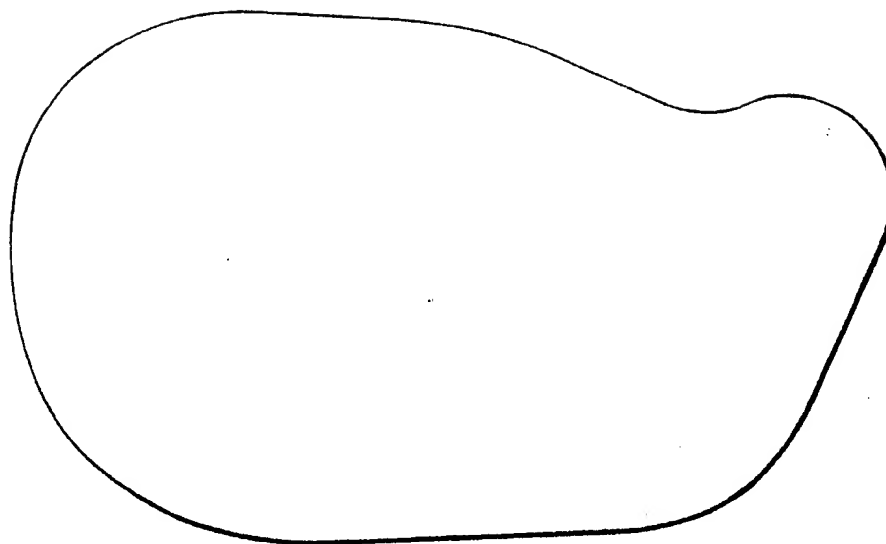


Fig. 2A

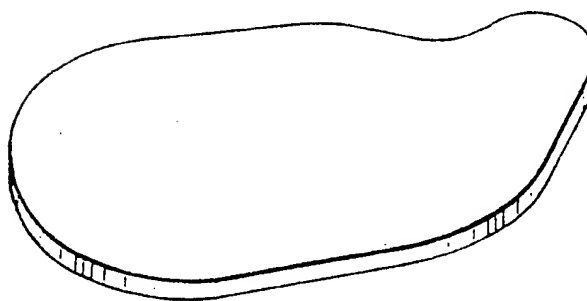


Fig. 2B

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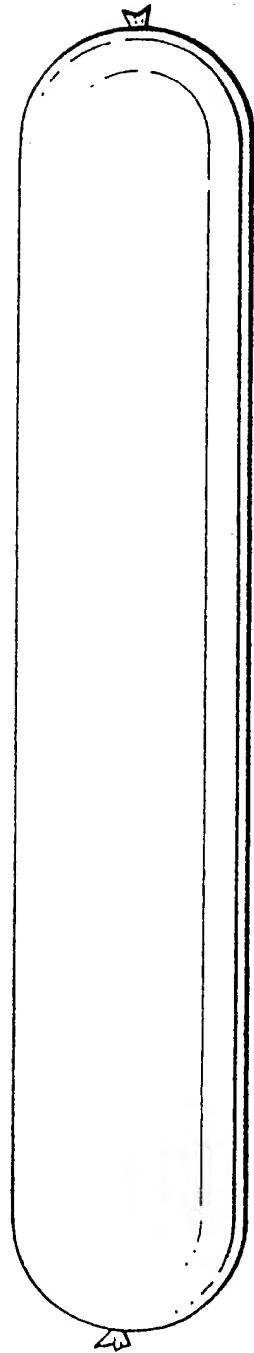


Fig. 3A

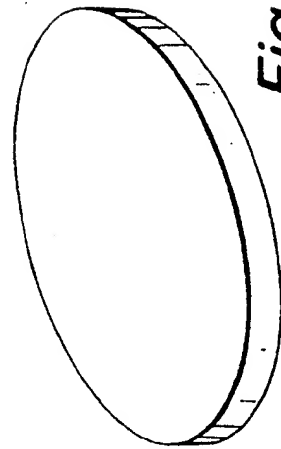


Fig. 3B

INTERNATIONAL SEARCH REPORT

International Application No

PL/GB 99/01854

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A23L1/314 A23C9/123

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A23L A23C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A,P	WO 99 21438 A (MATTHEWS BERNARD PLC) 6 May 1999 (1999-05-06) cited in the application	
A	EP 0 649 598 A (ONKEN GMBH) 26 April 1995 (1995-04-26)	
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☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

7 September 1999

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 99/01854

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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